

Winter Science Bee - Round 2

Round 2 Tossups

(1) The lift-inducing variety of this force can be increased with a larger aspect ratio of an aerofoil. Lord Rayleigh [[RAY-lee]] devised the quadratic form of this force, which is proportional to the square of an object's velocity. This force's namesake coefficient is composed of the impact from the parasitic and skin-friction types of this force. For the point, name this force, the resistance to motion through a fluid.

ANSWER: **Drag** (accept Lift-induced, induced, or vortex **drag**; accept **Drag** due to lift; accept Quadratic **drag**; accept **Drag** coefficient; prompt on "friction" before mentioned)

(2) One of these structures named Strokkur [[STROH-koor]] was first made by an Icelandic earthquake in the late 1700s. These structures name a type of siliceous [[sih-LIH-syuss]] sinter which commonly makes up their "cone" variety. These structures are distinguished from perpetual spouters by their discharge-recharge cycle. For the point, name this kind of erupting hot spring, which include Old Faithful in Yellowstone.

ANSWER: **Geyser** (accept Cone **geyser**; prompt on "hot springs")

(3) One law describing this phenomenon gives the step up and step down voltage for a transformer. Faraday's Law of this phenomenon predicts the production of EMF through it. This phenomenon is used by circuit elements whose strength is measured in units named for Joseph Henry. This phenomenon is the primary mechanism for wireless charging. For the point, name this phenomenon in which a current is generated from a change in the magnetic field.

ANSWER: Electromagnetic **Induction** (or Magnetic **Induction**; accept Faraday's Law of **Induction**)

(4) When one of these organelles is broken up, microsomes are formed. Proteins tagged with the retention motifs KKXX and KDEL are unable to leave the membrane of this organelle. COPII [[COP-"TWO"]] is used to tag proteins being transported from this organelle to the Golgi [[GOAL"-jee]] apparatus. For the point, name this organelle that serves as a cell's main transportation system and surrounds the nucleus.

ANSWER: **Endoplasmic Reticulum** (or **ER**; accept Rough **Endoplasmic Reticulum** or Rough **ER**; accept Smooth **Endoplasmic Reticulum** or Smooth **ER**)

(5) This man proposed his most important mathematical ideas in the book *The Laws of Mathematical Thought*. Statements named for this man can be simplified using a Karnaugh [[KAR-noh]] Map. A satisfiability problem named for this man was the first such problem to be proven to be NP-complete. For the point, name this English logician whose namesake algebra uses ones and zeros to represent "true" and "false."

ANSWER: George **Boole** (accept **Boolean** Algebra; accept **Boolean** Satisfiability Problem)

(6) Due to the Coriolis [[koh-ree-OH-liss]] force, the direction of these phenomena is described by the Ekman spiral. The deep variety of these phenomena is driven by thermohaline [[ther-moh-HAY-leen]] circulation. These phenomena form the confines of gyres [[GIRES]] such as the Sargasso Sea. Benjamin Franklin was the first person to chart one of these phenomena in the Atlantic Ocean. The Gulf Stream is a prominent warm-water version of these phenomena. For the point, name these large flows of water that circulate water through the world's oceans.

ANSWER: Ocean **Currents**

(7) The equivalence ratio describes the ideal mix of reactants for performing this reaction. The temperature at which a volatile compound undergoes this reaction most readily is called the flashpoint. Smoldering is an extended, slow rate form of this reaction. The incomplete form of this reaction produces carbon monoxide and solid carbon instead of the typical CO₂ and water. For the point, name this form of rapid exothermic redox reactions in which fuel is burned.

ANSWER: **Combustion** (accept Incomplete **combustion**; accept **Burning** before mentioned; accept answers indicating **Flames** or **Fire** before "flash point," and prompt afterward; prompt on "oxidation," "reduction," or "redox" reactions)

(8) This disease's primary subtypes are the ductal and lobular varieties. This disease's likelihood is increased by the presence of mutations to the BRCA1 and BRCA2 genes. Surgical treatments for this disease include a lumpectomy or a mastectomy. Awareness groups for this disease use pink ribbon logos. For the point, name this cancer, found most commonly in women, which can be detected with a mammogram.

ANSWER: **Breast Cancer** (accept Ductal **carcinoma**; accept Lobular **carcinoma**; prompt on "cancer")

(9) Devices used for this technique sometimes utilize cooling tubes called condensers to re-liquify the product of this technique. The fractional form of this technique is used to refine petroleum products. This technique, which cannot separate azeotropes [[AY-zee-oh-tropes]] without an additional component, is used to produce spirits from fermented products. For the point, name this technique of separating mixtures based on boiling point.

ANSWER: Classical **Distillation** (accept Fractional **distillation**)

(10) The discovery that these objects were once much more plentiful in the early universe helped refute the steady-state thesis. Gravitational lensing can cause multiples of these objects to appear, as in an Einstein cross. These objects form where a supermassive black hole rapidly accretes new matter, emitting energetic jets and winds. For the point, name these highly luminous active galactic nuclei.

ANSWER: **Quasars** (accept **Quasi-Stellar Radio Sources**; accept **Quasi-Stellar Objects** or **QSOs**; prompt on "Active Galactic Nuclei" or "AGN" before read)

(11) The enzyme gamma-glutamyl carboxylase [[kar-BAHK-sih-"lace"]] uses this nutrient as a cofactor for the production of GLA proteins. The most common types of this nutrient are phyloquinone [[fih-loh-KWY-nohn]] and menaquinone [[meh-nah-KWY-nohn]]. This vitamin, which is synthesized by gut bacteria, is often given as a shot to newborn babies to prevent hemorrhaging. For the point, name this vitamin found in dark, leafy plants, which is necessary for blood clotting.

ANSWER: Vitamin **K**

(12) This material releases heat as it cures, requiring coolants such as water or liquid nitrogen to be pumped through it as it sets. This material's reinforced type is augmented with steel rebar. This material is composed of rough aggregate held together with a binding agent. For the point, name this material made of stone set in cement that is used to make structures such as buildings and dams.

ANSWER: **Concrete** (accept Reinforced **concrete**; prompt on "cement" until mentioned)

(13) The energy of these particles can be calculated by multiplying the Planck constant times frequency. Young's double-slit experiment showed that these particles can interfere with themselves. The collision of these particles with metals can release electrons as part of a certain "electric" effect. These bosons are the carrier of the electromagnetic force. For the point, name these massless particles, the quanta of light.

ANSWER: **Photons**

(14) Harvests of this crop can be devastated by outbreaks of Ramu stunt. Bagasse [[bah-GAHSS]] is a potential energy source produced as a byproduct of this crop, of which Brazil is the world's leading producer. Production of this crop in the Caribbean is the largest driving force in deforestation in the region. Molasses is a valuable byproduct from processing this crop. For the point, name this perennial grass, a crop grown to produce a namesake sweet substance.

ANSWER: **Sugarcane** (prompt on "Sugar")

(15) When cracks in this material are filled with a siliceous [[sɪh-LIH-see-yuss]] ironstone matrix, it is known as this material's "boulder" form. The Australian town of Lightning Ridge is famous for producing this material's "black" form. This material fluoresces UV light and can create rainbow-like reflections. For the point, name this hydrated, amorphous type of silica, whose gem grade varieties are noted for their iridescence.

ANSWER: **Opal** (accept Boulder **opal**; accept Black **opal**; prompt on "Silica" before mentioned)

(16) These events are believed to be the source of all of the universe's heavy elements. One type of these events occur when the mass of an inert core overcomes degeneracy pressure, causing core collapse. The 1a type of these events are used as a standard candle and occur when a white dwarf exceeds the Chandrasekar [[chahn-drah-SEH-kar]] limit. For the point, name these extremely bright stellar events, the explosion of a star.

ANSWER: **Supernova** (accept Type 1A **Supernova**; prompt on "SN" or "SNe"; do not accept or prompt on "nova")

(17) The most common type of this ecosystem is the "fringing" variety, which grows in shallow waters just below the surface. These ecosystems can create atolls when the island around which they grow erodes below sea level. These ecosystems are formed from colonies of polyps held together by calcium carbonate. For the point, name this ecosystem, the largest of which is the Great Barrier in Australia.

ANSWER: **Coral Reef** (accept **Fringing reef** or Fringing **coral reef**; prompt on "Reef" or "Great Barrier Reef")

(18) In fruit flies, these phenomena involve the PER/TIM loop. Environmental cues called zeitgebers [[ZITE-geh-buhs]] entrain these phenomena which are triggered by the release of melatonin from the pineal [[pih-NEE-ahl]] gland. Exposure to artificial blue light can disrupt these phenomena, which are controlled by the suprachiasmatic [[soo-prah-kai-ahs-MAH-tik]] nucleus. For the point, name this phenomenon, the body's natural sleep-wake cycle.

ANSWER: **Circadian Rhythm** (or **Circadian Clock**; or **Circadian Cycle**)

(19) In a Birch reduction, a solution of this element is dissolved in ammonia, where it forms a double bond with benzene. This element was first isolated by Sir Humphrey Davy by using electrolysis [[ee-lek-TRAH-lih-siss]] on this element's hydroxide, which is also called caustic soda, or lye. This element is exchanged with potassium in an active transport pump. For the point, name this element that reacts with chlorine to form table salt.

ANSWER: **Sodium** (accept **Na**; or **Natrium**)

(20) The highest point on this body is Ahuna [[ah-HOO-nah]] Mons, which is covered in bright salt deposits left by cryo-volcanism. Along with Uranus, this body's existence was predicted by the now-debunked Titius-Bode [[TIH-tee-us BOAD]] law. Along with Vesta, this sole dwarf planet of the inner Solar System was visited by the Dawn spacecraft. For the point, name this largest asteroid, which is named for the Roman goddess of the harvest.

ANSWER: 1 **Ceres**

(21) One of the oldest treatises on this profession was written by the Indian thinker Sushruta [[soo-SHROO-tah]], which forms the basis of the Ayurveda [[ah-yoor-VEH-dah]] form of this profession. Much modern knowledge of the historical western practice of this profession derives from the works of Galen [[GAY-len]]. The code of ethics governing this profession is often written to include the phrase "first, do no harm." For the point, name this profession which is governed by the Hippocratic oath.

ANSWER: **Medicine** (accept **Medical**; accept **Doctors**; accept **Healing**; accept **Surgery**; accept synonymous answers)

(22) This element can be n-doped with phosphorus and p-doped with boron. This element's crystalline form is the primary component of photovoltaic cells. Integrated circuits frequently utilize a thinly sliced "wafer" of this element. This element is the most common material used in modern semiconductors. For the point, name this element with atomic number 15, which sits directly below carbon on the periodic table.

ANSWER: **Silicon** (or **Si**)

(23) The most dangerous part of this disease originally came from CTX-phi [[C-T-X-fai]] bacteriophages [[bak-TEE-ree-oh-fay-jes]]. This disease, which is caused by a namesake bacteria-derived toxin, is sometimes called The Blue Death. The main treatment for this disease involves lightly sweetened water-based liquids or oral rehydration therapy. For the point, name this bacterial disease spread by contaminated drinking water, which causes diarrhea so severe it can cause fatal dehydration.

ANSWER: **Cholera** (accept **Cholera** toxin or **Cholera**gen; accept **Blue Death** before mentioned)

(24) This constellation's lower left contains the Horsehead Nebula. This constellation's namesake nebula contains the Trapezium [[trah-PEE-zee-um]] Cluster. This constellation contains the Amazon Star, Bellatrix [[BEH-lah-triks]]. The stars Alnitak [[al-nih-TAHK]], Alnilam [[al-nee-LAHM]], and Mintaka [[min-TAH-kah]] make up this constellation's namesake "belt." This constellation's brightest stars are Rigel [["RYE"-jel]] and Betelgeuse [[BEH-tel-"juice"]]. For the point, name this constellation depicting a hunter from Greek mythology.

ANSWER: **Orion** (accept **Orion** nebula or Great **Orion** nebula; accept **Orion**'s belt)

(25) This organ can possess a benign accessory duct named for Giovanni Domenico Santorini. This organ releases its namesake digestive juices into the small intestine through the Duct of Wirsung [[VEER-zoong]]. This organ's endocrine-producing cells are contained within the Islets of Langerhans. Type One diabetes is caused by the immune system attacking this organ's beta cells. For the point, name this organ that secretes insulin.

ANSWER: **Pancreas** (accept **Pancreas** juice(s))

(26) Thermal effects can induce super-paramagnetic limits in these devices. Modern computers typically replace these devices with solid-state technology. Individual blocks of data in these devices can be retrieved in any order, allowing for random-access memory. For the point, name this component of a computer used for long-term storage, whose capacity can be measured in terabytes or megabytes.

ANSWER: **Hard Drive** (or **Hard Disk** Drive; or **HDD**; or **Fixed Disk**; prompt on "storage" or "disk"; do not accept or prompt on "memory")

(27) This entity is theorized to primarily exist within a namesake "halo." This entity can be indirectly observed through anomalies in galactic rotation curves. Candidates for the composition of this entity include GIMPS, WIMPS, and sterile neutrinos. This entity gets its name from interacting with gravity but not electromagnetic radiation, making it hard to detect. For the point, name this form of matter which is believed to make up 80 percent of the known mass in the universe.

ANSWER: **Dark Matter** (accept **Dark Matter** halo; do not accept or prompt on "dark energy")

(28) According to Carmichael's Theorem, for every value over twelve, the nth member of this construct will have at least one unique prime divisor. This construct's closed-form expression can be found with Binet's [[bih-NEHS]] formula. This construct converges at the golden ratio and is illustrated with a tiling spiral. For the point, identify this sequence named for an Italian mathematician, whose first five numbers are 1, 1, 2, 3, 5.

ANSWER: **Fibonacci** Sequence (or **Fibonacci** Numbers)

(29) This scientist posited the existence of an "aperiodic crystal" in the book *What is Life?*, which later inspired the discovery of DNA. This scientist's namesake equation governs the wave function of a quantum-mechanical system. This scientist created a thought experiment involving a Geiger counter, a hammer, and poison to illustrate flaws with the Copenhagen interpretation of quantum mechanics. For the point, name this Austrian physicist who is best remembered for theorizing a cat who is both dead and alive.

ANSWER: Erwin **Schrödinger** (or Erwin Rudolf Josef Alexander **Schrödinger**; accept **Schrödinger**'s Cat; accept **Schrödinger** equation)

(30) Mike Alder created a philosophical razor named for this man's "flaming laser sword." In one thought experiment, this scientist imagined a cannon tall enough to fire a cannonball into orbit. This scientist names the standard SI unit of force, and, coinciding with Leibniz [[LIBE-nitz]], this author of *Principia Mathematica* independently developed calculus. For the point, name this English physicist who described the three laws of motion and a namesake law of universal gravitation.

ANSWER: Isaac **Newton** (or Sir Isaac **Newton**; accept **Newton**'s flaming laser sword; accept **Newton**'s laws of motion)

Extra Question

(1) This disease can be prevented with the Bacillus Calmette-Guérin [[bah-SIH-lus kal-MET-gweh-RAHN]] vaccine. Pott disease is a variety of this condition that infects the spine. This disease can be treated with the four-drug RIPE [["RIPE"]] regimen. The formation of a bump under the skin in the Mantoux [[man-TOO]] test is a positive sign for this disease which presents as nodules that can be viewed with a chest x-ray. For the point, name this respiratory disease caused by mycobacterium, which was historically called consumption.

ANSWER: **Tuberculosis** (or **TB**; accept **Consumption** before mentioned)